# Waste Reduction Partners

Welcomes You to

# "Identifying Energy Saving Opportunities"

Presented by
Conrad Meyer, WRP Technical Manager

October 1, 2014

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# Sponsored by:

Triangle J Council of Governments

Land-of-Sky Regional Council

State Energy Program
Division of Environmental Assistance & Customer Service

NC DENR
Division of Environment and Natural Resources

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# Waste Reduction Partners – Who are we?

- Volunteer team of 65 retired engineers and scientists
- Perform no cost energy, water, and solid waste assessments in NC
- Grant funded by local, state, and federal governments – funds used for administration and stipends for volunteers
- FY2013-14 performance:
  - $1.75 million in utility savings
  - 2.75 million gallons of water use reduction
  - 6,790 tons of material diverted from landfills
  - 162 clients assisted in 47 counties.

  Since 2000 - $70 million in client savings

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# Energy Assessments

- Imagine for a moment that you have just been tasked with reducing energy costs in all your rest areas
- How do you begin and what process might you follow to identify savings opportunities?
  - You have a wide variety of buildings –
    - Many buildings throughout your state
    - Old vs new construction
    - Simple rest rooms & vending vs more complex plazas and visitor centers
    - Differing climate across the state

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# Identifying Opportunities: Basics of Conducting an Energy Audit

Understanding ASHRAE Audit Level: Walk-through 1, 2, 3

- Scope
- Energy/utility bill review – Before site visit
- Have the right people on the team
- Data collection during site visit
- Getting the questions answered
- Recommendations
- Financial analysis

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# Top Areas to Save Energy

- Utility Accounting/Benchmarking
- Lighting
- Heating, Cooling, and Controls
- Hot Water and Water  Conservation
- Equipment, Machines and Processes
- Building Envelope Improvements

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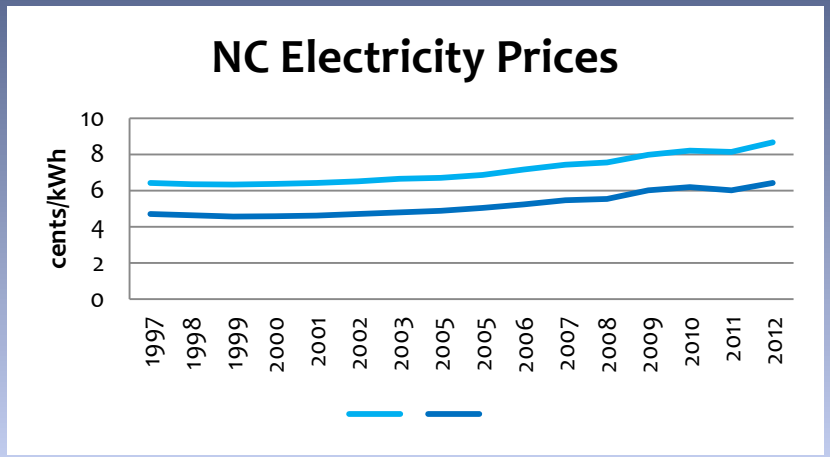
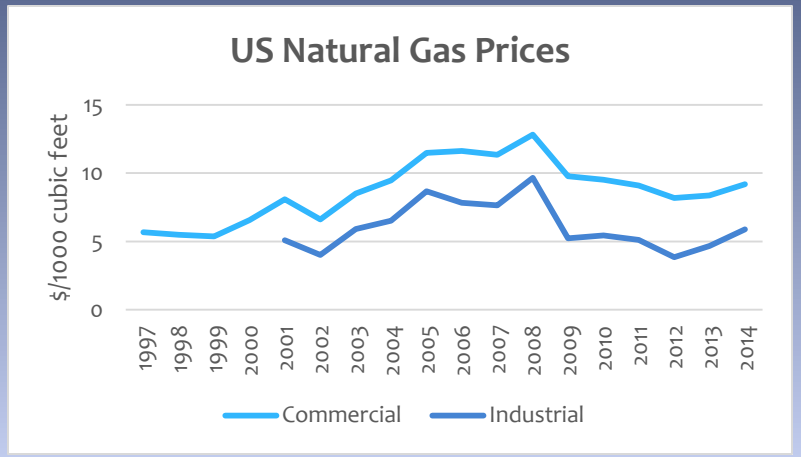
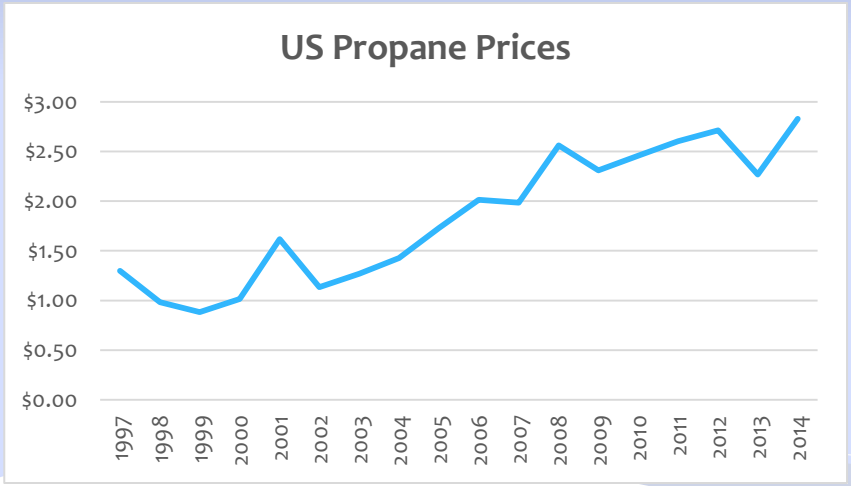
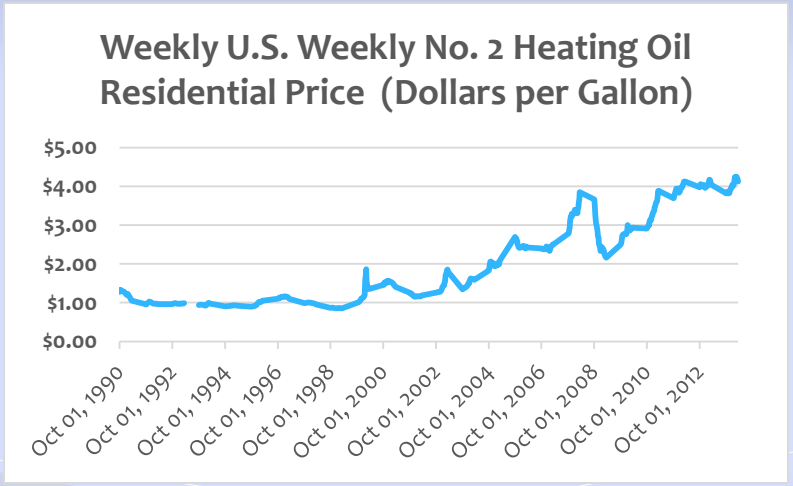
# Energy Prices are Steadily Increasing

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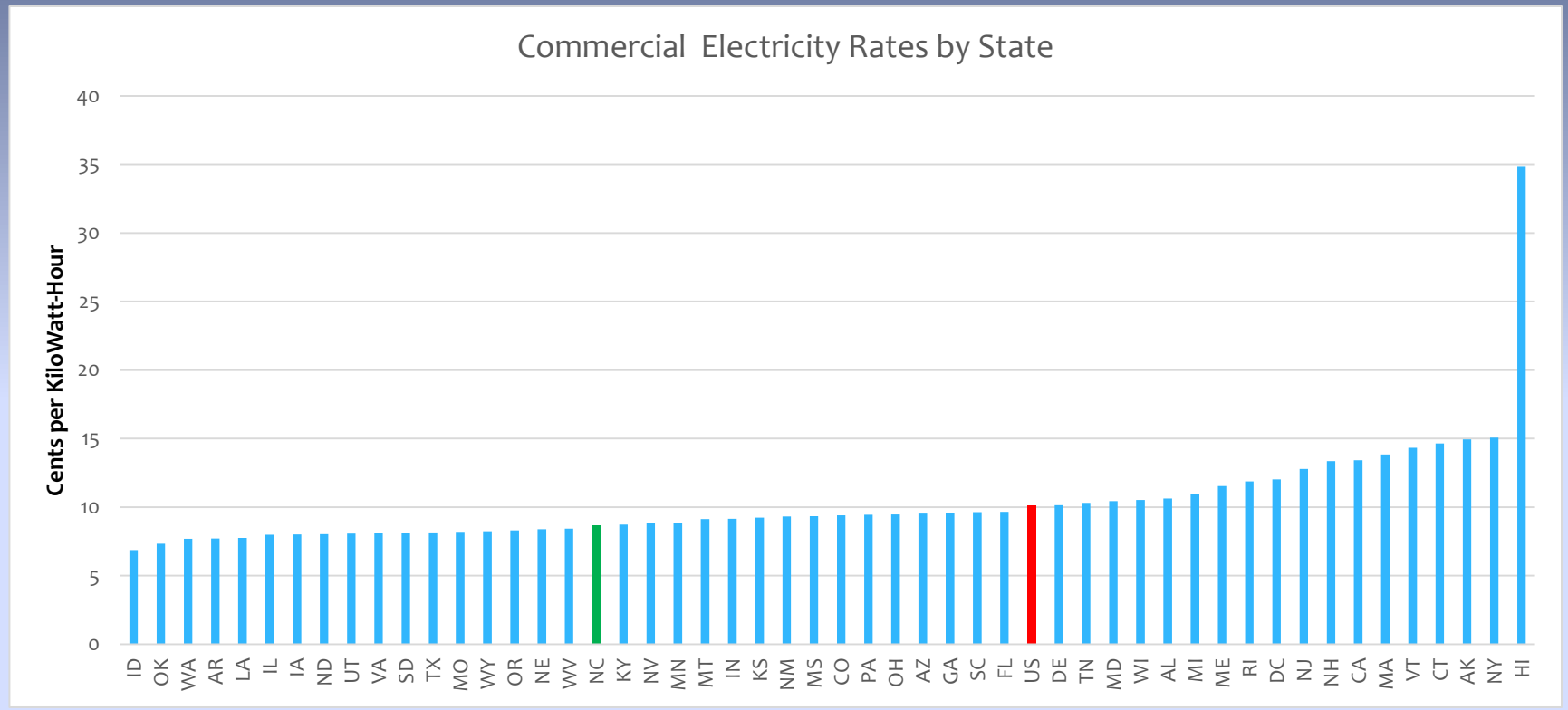
Data from www.EIA.gov

# Electric Rates Vary by State




Data from www.EIA.gov

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# Fuel Cost Comparison

NC Commercial Averages

- Electricity: $0.085/kWh (3412 Btu/kWh)
- Natural gas $1.05/therm (100,000 Btu/therm)
- Propane $2.45 / gallon (91,500 Btu/gal)
- #2 Fuel Oil $3.00 /gallon (~140,000 Btu/gal)

Unit Energy Comparisons - Heating

- Propane Furnace: $31.32/MMbtu
- Electric Strip Heat: $24.90/MMbtu
- #2 Oil Furnace: $24.51/MMbtu
- Natural Gas Furnace: $13.35/MMbtu
- Heat Pump: $7.78/MMbtu

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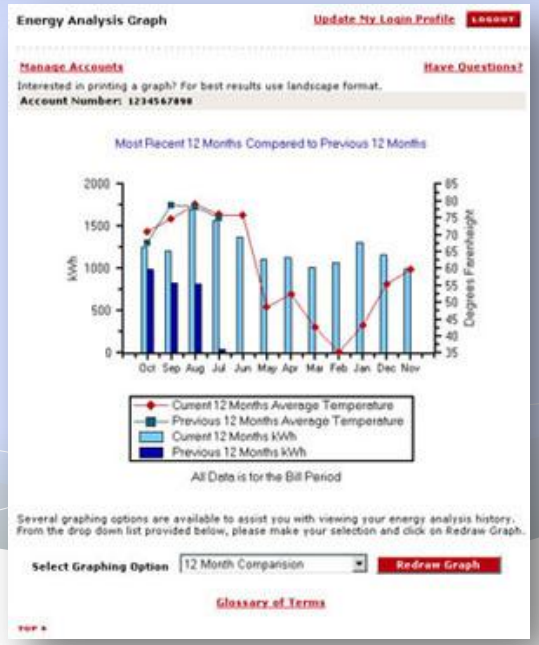
# Utility Accounting

- Are you tracking energy consumption?
- Electricity: usage “kWh” and demand “kW”
- Utility Rate Structures:  General Service, Medium General Service, Time of Use, etc.
- Easy ways to track bills
  - Go online to view
  - Portfolio Manager (EPA)

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# Utility Rate Analysis

- No capital investment required
- Are you on the best electric rate schedule?
- When to check?  Annually or when building use changes
- Who to work with?  Utility representatives
- Do you understand how your rate schedule works?
- Many rate schedules – some are complicated
- Shifting peak loads if on a Time of Use schedule

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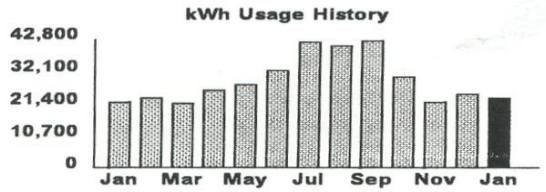
*NC State Agencies are saving $650,000 annually through energy rate reviews.*

# Example: Commercial Electric Bill

00045858 1 AV 0.278 00 **AUTO **C004

Customer Name
Address
ASHEVILLE NC 28801-3271




## Customer Bill

page 1 of 2

| | | |
|---|---|---|
| Account number | | 595 116 9860 |
| **Total due** | | **$1,904.39** |
| **Current charges past due after** | | **Feb 4** |
| Thank you for your payment | Jan 2 | $2,113.30 |
| Usage period | | Dec 18 - Jan 20 |
| This bill was mailed on | | January 21, 2004 |

**Usage**

| | | | |
|---|---|---|---|
| Meter number | | | TA3536 |
| Readings: Jan 20 | | | 9787 |
| Dec 18 | | - | 9588 |
| Meter constant | | x | 120 |
| **kWh usage** | | | **23880** |
| Days in period 33 | Average kWh per day | | 724 |
| Actual kW Demand | | | 80.40 |

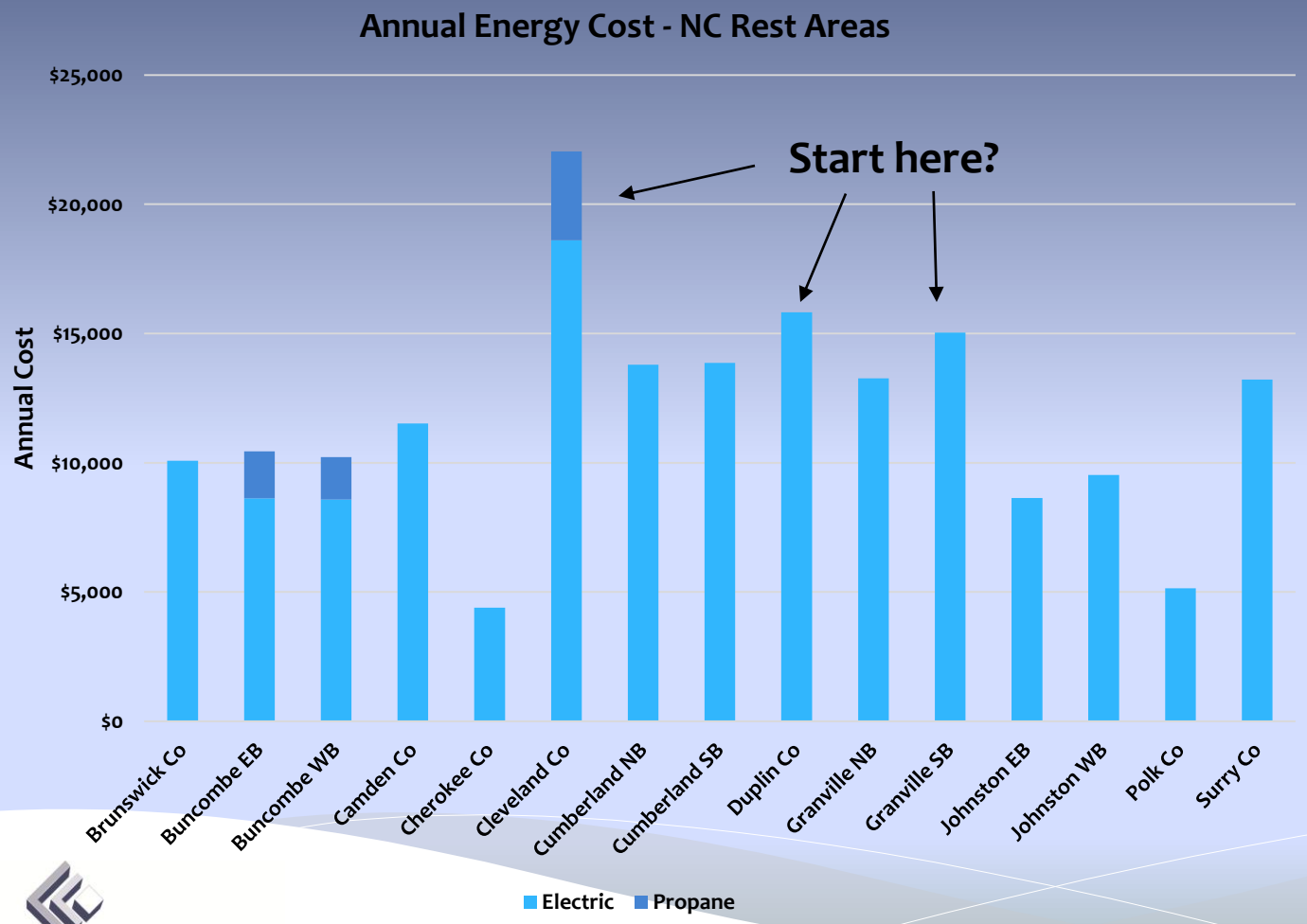
**Billing**

| | | | | | |
|---|---|---|---|---|---|
| **MGS rate** | | | | | 33 Days |
| | Basic customer charge | | | | 12.00 |
| | Energy charge | 23,880 kwh | x | $0.05132 | 1,225.5216 |
| | Demand charge | | | | |
| | (80% of 132.00 kw (09/03)) | 105.60 kw | x | $4.89000 | 516.3840 |
| | Three phase service charge | | | | 9.00 |
| **ALS rate** | | | | | 33 Days |
| | Metal halide light, 160 kwh, 40000 lumens, flood | | | | |
| | Area lighting | 1 Light | x | $25.63 | 25.63 |
| | Wood pole charge | 1 Pole | x | $2.16 | 2.16 |
| **ALS rate** | | | | | 33 Days |
| | High Pressure Sodium light, 46 kwh, 9500 lumens, flood | | | | |
| | Area lighting | 1 Light | x | $11.15 | 11.15 |
| **ALS rate** | | | | | 33 Days |
| | High Pressure Sodium lights, 109 kwh, 28500 lumens, flood | | | | |
| | Area lighting | 3 Lights | x | $15.69 | 47.07 |
| | 3% North Carolina sales tax | | | | 55.47 |
| | **Total due** | | | | **$1,904.39** |

**Please detach here.** **Turn over for helpful phone numbers and customer service tips.** **PIN:**

Similarly, look at your other energy bills

# NC Rest Areas - Annual Energy Costs

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# Annual Energy Benchmarking

| MONTH | YEAR | ELECTRICITY CONSUMPTION kWh | COST $ | PROPANE CONSUMPTION gallons | COST $ |
|---|---|---|---|---|---|
| MAY 2009 | 2009 | 12360 | 888.39 | | |
| JUNE 2009 | 2009 | 15500 | 1083.54 | | |
| JULY 2009 | 2009 | 20640 | 1468.64 | | |
| AUGUST 2009 | 2009 | 20440 | 1479.42 | | |
| SEPTEMBER 2009 | 2009 | 18900 | 1399.29 | | |
| OCTOBER 2009 | 2009 | 17900 | 1294.09 | | |
| NOVEMBER 2009 | 2009 | 12700 | 925.68 | | |
| DECEMBER 2009 | 2009 | 11920 | 874.28 | | |
| JANUARY 2010 | 2010 | 13060 | 919.33 | | |
| FEBRUARY 2010 | 2010 | 10580 | 745.26 | | |
| MARCH 2010 | 2010 | 11260 | 778.32 | | |
| APRIL 2010 | 2010 | 13260 | 946.31 | | |
| | | | | | |
| TOTAL Electricity Usage | | 178,520 | $12803 | 1,995 | $3011 |

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USI SPREADSHEET IN PACKAGE

# Annual Energy Benchmarking

| | | | CONVERSION TO BTU EQUIVALENTS | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Electricity | 178520 kWh | X | 3,413 Btu / kWh | = | 609 | Million Btu's |
| Propane | 1995 gal | X | 92,000 Btu/gallon | = | 184 | Million Btu's |
| TOTAL SQ FT = 3,727 | | | | | | |
| | | | | | | |
| | | | TOTAL ENERGY USE | = | **793** | Million Btu's |
| | | | | | | |
| TOTAL ENERGY Index = 793 mmBTU/3727 sq ft = | | | | | 213 | kBtu /sq ft |
| | | | | | | |
| TOTAL COST INDEX = $15,814/3,727 sq ft = | | | | **=** | $4.24 | per sq ft |

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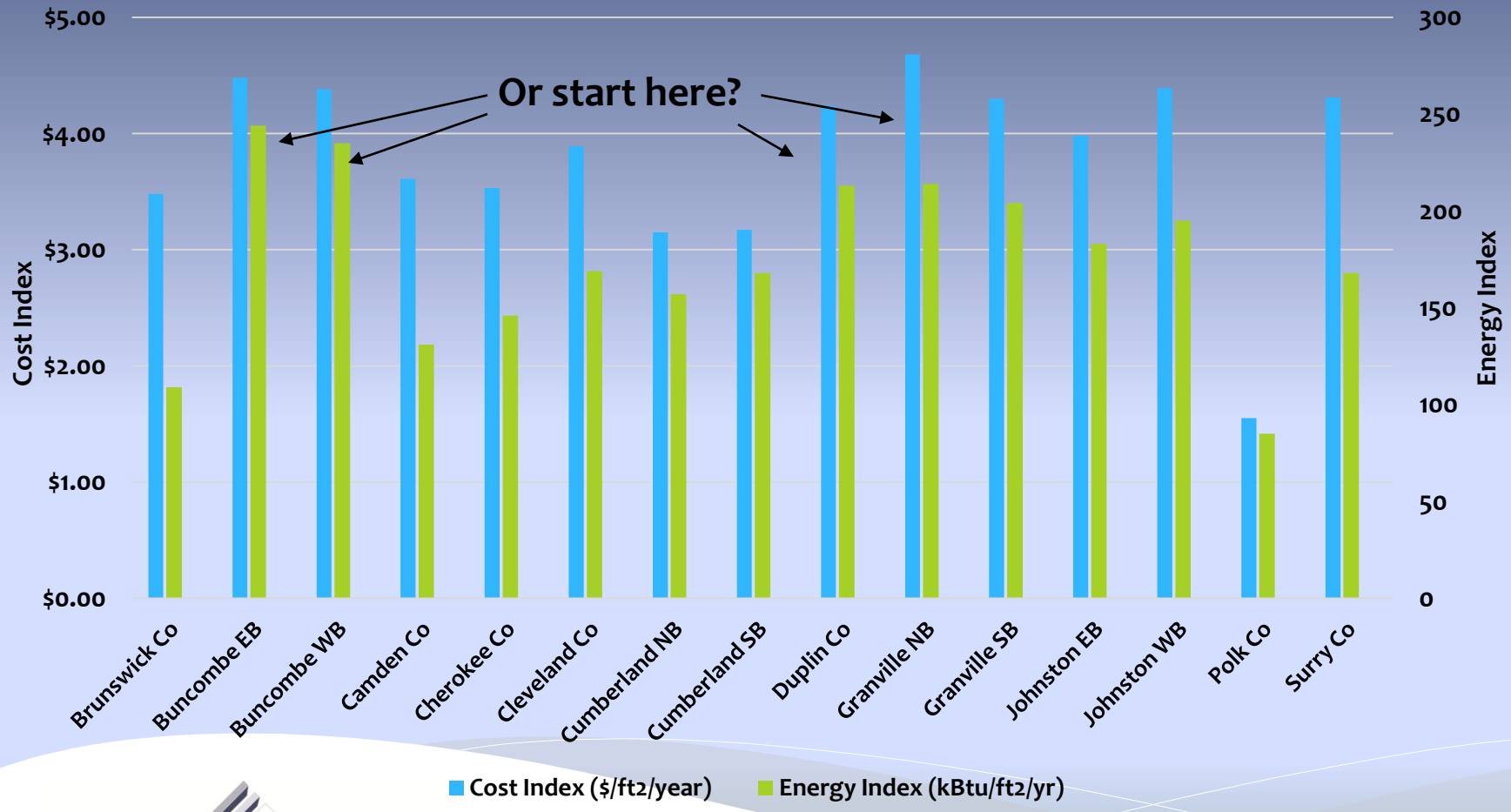
# NC Rest Area Benchmarks

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**Rest Areas are heavily influenced by outdoor lighting!**

# How to proceed?

- Collect and analyze energy data.  Does it make sense?
- Look at your major energy users for savings
  - For rest areas:
    - HVAC
    - Lighting
    - Hot water
    - Building Envelope

    - Can use the USI Checklist to get started
    - Also WRP has Fact Sheets and Best Management Practices at: http://wastereductionpartners.org/resources

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# HVAC Efficiency

## Common Opportunities for Rest Stop

- Establish a high performance specifications for replacements
- For Example, minimum 15 SEER, 12.5 EER
- Reference: CEE1.org, local utility rebate program specs

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# Maintenance Saves Money

## Establish maintenance program contracts

- Air Filters - Replace regularly (4.1% savings)
- Heat transfer coils - Clean in heat pumps, air conditioners, and chillers (1.3 to 3.7% savings)
- Ducts - Inspect ducts for leakage and missing insulation
- Obstructions - Remove obstructions to radiators, air diffusers, intakes, outdoor equipment
- Boilers - Have fuel-fired boilers inspected annually (4% savings)

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# Optimize Temperature Controls

- Programmable 7-day Thermostats

  Locked Cover / Password Protected
- Low occupancy - nighttime setbacks
  - 6 degrees Summer
  - 8 degrees Winter
  - Commons savings > $150/year
- Review summer/winter set points
  - 1 degree change saves 3%


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# Lighting – Energy Savings

## Lighting technologies are rapidly changing!

- Turning Lights Out
- Delamping /Reducing Wattage
- LED Upgrades
- T-8 Upgrades
- Occupancy Controls
- Outdoor Lighting - photo cells
- LED Exit Signs

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# Target Light Levels

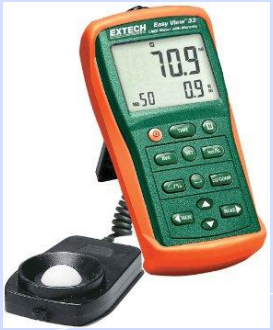
- The goal is to provide sufficient illumination for people to do their activities comfortably and in an aesthetically pleasing environment.
- How much light is enough?

  Illuminating Engineering Society of North America (http://www.iesna.org/) sets officially recognized standards measured in foot candles (or lux) in buildings.

| Illumination Level for Space / Task | Foot candles, fc |
|---|---|
| Lobbies , Reception Areas | 10-30 |
| Typical Offices | 30-50 |
| Meeting Rooms | 30-50 |
| Kitchen | 30-50 |
| Retail | 50-100 |
| Guest Rooms | 10-30 |
| Corridors, Elevators, Stairs | 5 minimum |
| Parking Garage | 10 |

Aesthetics are equally important

- Color temperature
- Color rendering




Determine the amount of light produced by current fixtures (measured in lumens). Proportionally increase or decrease target lumens per fixture if necessary to bring illumination to recommended standards.

# More Efficient Replacement

Lamp and ballast replacement using existing fluorescent fixtures

- Older facilities are likely to have 1.5 inch diameter fluorescent lamps (T12) with magnetic ballasts
- Replace with 1 inch diameter fluorescent lamps (T8) and electronic ballasts
- 15 –35 % higher efficiency
- LED's becoming cost competitive

Example: 50 Watt reduction for a 4 lamp fixture
0.05 kW x 3000 hours x $0.085 per kWh = $13 per fixture per year

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# Life Cycle Cost Analysis

## Replacing a 65 Watt Incandescent Floodlamp with LED

Compare life cycle costs of a 25,000 hour LED to other bulbs

The effective electric rate is $.10 per kWh.

| | Incandescent | CFL | LED |
|---|---|---|---|
| Wattage | 65 | 15 | 15 |
| Lumens | 600 | 720 | 790 |
| Life of Bulb | 2,000 | 8,000 | 25,000 |
| Number of bulbs used in 25,000 hours | 12.5 | 3.1 | 1 |
| Price | $3.33 | $3.33 | $15.00 |
| Rebate | none | none | -$5.00 |
| Installation Labor | $5.00 | $5.00 | $5.00 |
| Operating Cost (Watts x 25,000 hr x rate x.001 kW per W) | $162.50 | $37.50 | $37.50 |
| Replacement Cost (Price x # of replacements) | $41.62 | $10.32 | $0.00 |
| Replacement Labor Cost (Install x # of replacements) | $62.50 | $15.50 | $0.00 |
| Total Cost for 25,000 hours (4.5 years @ 12 hr/day) | $266.62 | $63.32 | $52.50 |

Cost analysis should include initial cost and rebates, labor, replacement cost, and replacement labor.

# LED Application Examples

| LED Type and Output | | Lumens per Watt | | |
|---|---|---|---|---|
| **Application** | **Lumen Range** | **Average** | **Best** | **% Best over Avg.** |
| **Bulbs and Lamps** | | | | |
| General Purpose | 700-1,100 | 69 | 94 | 36% |
| Directional | 600-1,300 | 57 | 89 | 56% |
| MR16 | 400-600 | 55 | 77 | 40% |
| Decorative | 400-700 | 58 | 77 | 33% |
| **Luminaries** | | | | |
| Downlights | 600-1,500 | 49 | 88 | 80% |
| Troffers | 1,000-8,000 | 83 | 119 | 43% |
| High-Bay | 15,000-35,000 | 88 | 110 | 25% |
| Parking Garage | 1,000-6,000 | 72 | 106 | 47% |
| Parking Lot | 10,000-20,000 | 78 | 101 | 29% |
| Streetlights | 10,000-20,000 | 79 | 110 | 39% |

DOE Adoption of Light-Emitting Diodes in Common Lighting Applications
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf

Maximize benefits by selecting highest lumens per watt among options meeting other specs

# Credits, Incentives, and Rebates

DSIRE is a comprehensive database of information on state, federal, local, and utility incentives and policies that support renewable energy and energy efficiency. http://www.dsireusa.org/

Utility Incentives and Rebates are very common and they change often. Examples:

- Mass Save (NSTAR, national grid, others): Incentives of $30 per LED track fixture,$75 per LED replacement of 1x4' or 2x4' Fluorescent
  http://www.masssave.com/
- Mid American Energy (Iowa) has rebates of $10-$15 for LED screw in bulbs and $100 for 400 W HID equivalent
  http://www.midamericanenergy.com/ee/include/pdf/ia_bus_lighting_table.pdf
- NSTAR: Direct install for small business – Free energy audit and pays up to 70% of total project cost for retrofitting qualifying lighting
  http://www.nstar.com/business/energy_efficiency/electric_programs/direct_install_program.asp
- Duke Energy Progress: Similar to above
  https://www.progress-energy.com/carolinas/business/save-energy-money/sbes/index.page?

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Incentives and rebates offset the higher initial cost for LED upgrades

# Hot Water and Water Conservation

- Hot Water Setting and Controls
  - Reduce water heater temperatures to 110°F if allowable (local codes vary)
  - Insulation blankets and pipe insulation save energy
- Use Low-flow Fixtures
  - Hand washing (0.5 gallons/minute)
    - Self actuating
  - Shower heads (1.5 gallons/minute)
  - High Efficiency Toilets (1.28 gpf) and Urinals (0.125 gpf)
- These strategies save energy, water, and sewer charges

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# Vending Machines



Background

- Typical refrigerated vending machine consumes 400 watts, $225/year

Opportunities

- Delamping – up to 180 watts reduction, $100/yr savings
- Energy saving sensors – 30-50% savings, Typical cost: $170/unit, < 2 yr payback

Example:

- 51% savings, $185/yr savings @ 8.5cents/kWh measured with recording ammeter

Future/Better Ideas

- Vendor requirement in new contracts – emphasis on saving energy especially when the vending area is well illuminated

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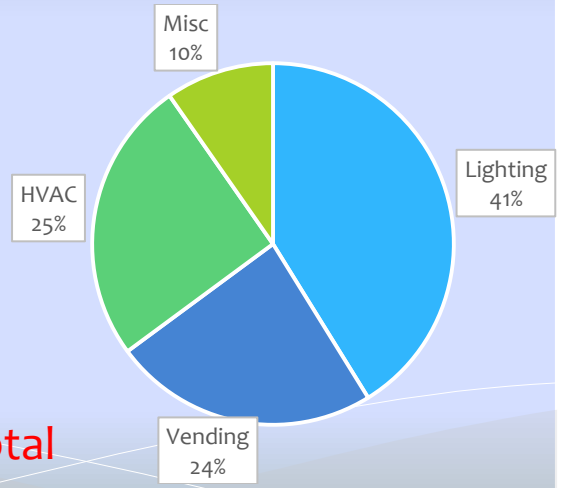
# Detailed Assessment Report

**Rest Stop Current Energy Usage and Potential Savings**

| | Current Energy Cost | Current Energy Index kBtu/sq ft/yr | Savings if Measures are Implemented | % Savings | Highest Value Opportunity |
|---|---|---|---|---|---|
| **Brunswick** | $10,075 | 109 | $1,109 | 11% | Remove excess lighting |
| **Buncombe/Henderson** | $20,664 | 239 | $4,715 | 23% | HVAC maintenance and programmable thermostats |
| **Camden** | $11,522 | 131 | $2,098 | 18% | Vending machine lights |
| **Cherokee** | $4,386 | 146 | $694 | 16% | Replace T12 lighting |
| **Cleveland** | $22,044 | 169 | $2,331 | 11% | Vending machine lights |
| **Cumberland** | $27,663 | 163 | $6,497 | 23% | HVAC maintenance and programmable thermostats |
| **Duplin** | $15,814 | 213 | $1,015 | 6% | Vending machine lights |
| **Granville** | $28,304 | 209 | $5,542 | 20% | HVAC maintenance and programmable thermostats |
| **Johnston** | $18,168 | 167 | $2,210 | 12% | HVAC maintenance and programmable thermostats |
| **Polk** | $5,139 | 85 | $891 | 17% | Vending machine lights |
| **Surry** | $20,573 | 168 | $6,132 | 30% | HVAC maintenance and programmable thermostats |
| **Average** | $16,759 | 164 | $3,021 | 18% | |
| **Total** | | | $33,234 | | |

| Estimated Annual Energy Savings | |
|---|---|
| Energy Savings $ / year | $33,234 |
| Energy Savings MMBtu/year | 1500 |
| **Estimated Annual Emissions Reductions** | |
| Carbon Dioxide ($CO_2$) | 262 tons |
| Nitrogen Oxides (NOX) | 0.64 tons |
| Sulfur Oxides (SOX) | 1.68 tons |




Opportunities represent 19% of total energy costs of $177,000

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# Recycling
## Make your program the example!

- Take advantage of "Single Stream" recycling vendors
- **"Twin the Bin"** - everywhere
- NCDOT rest areas experienced 2-4 times increase in recycling collection after "Twinning the Bin"

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# WRP Contacts

## WRP Triangle J Council of Governments

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## WRP Land-of-Sky Regional Council

Land-of-Sky Regional Council

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Russ Jordan, Energy Manager
Terry Albrecht, PE, CEM State Director

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www.wastereductionpartners.org

# Backup

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# Utility Savings Initiative (USI)

Mission

- The Utility Savings Initiative (USI) is North Carolina's comprehensive, lead-by-example program to manage utility consumption and costs in the public sector. The primary responsibility of the Utility Savings Initiative is to coordinate and support the activities of the state agencies and UNC system institutions to manage and reduce utility consumption and cost.
- Customers & Participants: State Agencies, Universities, Community Colleges, K-12, local governments - 132 million square feet
- Assist public sectors in managing utility consumption and costs
- Team supports 30% energy use reduction by 2015 ('02-03 baseline) – Currently reduced benchmark usage by 29% (kBtu/$ft^2$/year)
  - Avoided over $614 million in energy costs and $72 million in water costs
- Performance Contracting oversight for large energy related projects

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# USI Checklist

**Administration and Energy Conservation Measures (ECM) Survey**

| | |
|---|---|
| **Site:** | |
| **Building:** (Name, year built) | |
| **Site Contact -Title** | |
| **Name:** | |
| **Phone:** | |
| **E-mail:** | |
| **County:** | |
| **Use** (Office, etc.) | |
| **Floor Area:** (GSF) | |
| **Street Address:** | |
| **Mailing Address:** | |
| **City:** | |
| **State:** | |
| **Zip Code:** | |

| | |
|---|---|
| **Surveyor Name:** | |
| **Team:** | |
| **Survey Date:** | |
| **Survey Time:** | |

| | |
|---|---|
| **# of floors** | |
| **# of occupants** | |
| **Hrs. occupied per week** | |

| **Utilities supplied to bldg. (Enter 1 if present, 2 if present and metered):** | |
|---|---|
| **Electric** | |
| **Dom cold water** | |
| **Natural gas** | |
| **Oil** | |
| **Propane** | |
| **Steam** | |
| **Heating hot water** | |
| **Chilled water** | |
| **Dom hot water** | |

**Client - Please complete the top of this page and pages 2 and 3**

**The section below is completed by WRP assessor.**

**Baseline Energy Data (See Annual Energy Consumption Worksheet):**

| | | |
|---|---|---|
| **Total energy consumed:** | 0 | Million BTUs of energy per year |
| **Total energy index:** | #DIV/0! | kBTU/sq. ft. per year |
| **Total energy costs:** | $0.00 | Per year |
| **Total energy cost index:** | #DIV/0! | Total Energy Cost |
| **Total water use:** | 0 | Gallons per year |
| **Water/sewer cost:** | $0.00 | Per year |
| **Gallons per Occupant:** | #DIV/0! | |
| **Gallons / sf** | #DIV/0! | |
| **After-hours usage/year -** | | |
| **After-hours usage/year -** | | |

## B. Building Envelope

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Roof type (check one) | B1. | Metal | | Composite | | Membrane | | Other | |
| Roof color (check one) | | Light | | Dark | | | | | |
| | B2. | Is roof insulated? | | | | | | | |
| | B3. | Are thermal windows used? Low-e? | | | | | | | |
| | B4. | Are overhangs present on east west facing windows? | | | | | | | |
| | B5. | Is weather stripping on windows and doors present and maintained? | | | | | | | |
| | B6. | Are interior shades present and adjusted to allow daylight and reject solar heat gain? | | | | | | | |
| | B7. | Are windows kept closed in conditioned spaces? | | | | | | | |

## C. Lighting and Electrical Systems

| | | |
|---|---|---|
| | C1. | Can lighting be controlled in perimeter rooms to make use of day light? |
| | C2. | Have T-12 fluorescent lamps been replaced with T-8? |
| | C3. | Are occupancy sensors utilized? |
| | C4. | Are computers using power-save feature? |
| | C5. | Have all incandescent lamps been replaced by CFL's? |
| | C6. | Are all electric exit lights of LED type? |
| | C7. | Do exterior lights turn off during daylight hours? |
| | C8. | Have space heaters been eliminated? |
| | C9. | Have beverage and snack machine lights been removed? |
| | C10. | Are procedures in place to purchase the most energy efficient equipment? |
| | C11. | Is fluorescent task lighting used to minimize background lighting? |
| | C12. | Has High-Bay T-5 lighting been evaluated for use in high ceiling areas (warehouses, gyms, auditoriums, etc.)? |
| | C13. | Have energy conservation decals been placed on light switches? |

## K. Recommendations

List top ECM recommendations (include estimated potential savings when possible). Indicate if building is a candidate for performance contracting.

K1.

| | |
|---|---|
| 1 | |

| | |
|---|---|
| Annual potential savings | |
| Cost to implement: | |
| Simple payback: | |

| | |
|---|---|
| 2 | |

| | |
|---|---|
| Annual potential savings | |
| Cost to implement: | |
| Simple payback: | |

| | |
|---|---|
| 3 | |

| | |
|---|---|
| Annual potential savings | |
| Cost to implement: | |
| Simple payback: | |

| | |
|---|---|
| 4 | |

| | |
|---|---|
| Annual potential savings | |
| Cost to implement: | |
| Simple payback: | |

## ANNUAL ENERGY AND WATER CONSUMPTION

| Month | Year | Electricity | | Natural Gas | | Other Fuels | | Water | $H_2O$ / Sewer |
|---|---|---|---|---|---|---|---|---|---|
| | | Usage | Cost | Usage | Cost | Usage | Cost | Usage | Cost |
| | | KWH | $ | Therms | $ | Units | $ | Gallons | $ |
| July | 2008 | | | | | | | | |
| August | 2008 | | | | | | | | |
| September | 2008 | | | | | | | | |
| October | 2008 | | | | | | | | |
| November | 2008 | | | | | | | | |
| December | 2008 | | | | | | | | |
| January | 2009 | | | | | | | | |
| February | 2009 | | | | | | | | |
| March | 2009 | | | | | | | | |
| April | 2009 | | | | | | | | |
| May | 2009 | | | | | | | | |
| June | 2009 | | | | | | | | |
| **12-month total** | | 0 | 0 | 0 | $0.00 | | | 0 | 0 |
| **Square footage:** | | | 0 | | | | | | |

**CONVERSION TO BTU EQUIVALENTS**

| **Fuel totals** | | | | | | |
|---|---|---|---|---|---|---|
| **Electricity -kWh** | 0 | x | 3,413 | BTU/kWh | 0 | Million BTU's |
| **Fuel oil - gallons** | 0 | x | 140,000 | BTU/GAL. | 0 | Million BTU's |
| **Natural gas - Therms** | 0 | x | 100,000 | BTU/THERM | 0 | Million BTU's |
| **Propane -** | 0 | x | 92,000 | BTU/GAL. | 0 | Million BTU's |
| | | | **Total energy use** | | 0 | Million BTU's |
| | | | **Cost per million BTU** | | #DIV/0! | Million BTU's |
| | | | **Total Energy Index** | | #DIV/0! | kBTU/SF |
| | | | **Total Cost Index** | | #DIV/0! | Per Sq. Ft. |

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# Detailed Assessment Report

| Savings – Switching of hallway lights |
|---|
| Estimated hours lights could be switched off: Weekends hrs = 10 hrs/day X 2 days X 52 weeks = 1,040 hrs. Schools out hours = 10 hrs/day X 5 days X 10 weeks = 500 hrs. Total hours = 1,040 + 500 = 1,540 hrs.<br>Cost Savings = 3 hallways X 23 fixtures X 75% switched off X .112 kwd/fixture X 1,540 hrs/year = 8,926 kWh X $.084 kWh = $750 Yr. |
| **Costs** |
| Costs = TBD. A very rough estimate is $400 per hallway, or $800. |
| Payback Period = $800/$750 = 13 months |

| Estimated Annual Energy Savings, $/yr | |
|---|---|
| Energy, Water & SW Savings | $4,459 |
| Energy Savings<br>MMBTU / year<br>kWh/yr | <br>119.96<br>32,500 |
| **Est. Annual Emissions Reductions, lbs/yr** | |
| Carbon Dioxide ($CO_2$)<br>1.19#$CO_2$/kWh * 32,500kWh/yr = | 38,675 |
| Nitrogen Oxides ()<br>0.00293#/kWh * 32,500kWh/yr = | 95 |
| Sulfur Oxides ($SO_X$)<br>0.00761#$SO_X$ * 32,500kWh/yr = | 247 |

| Summary of Energy Benchmarks | |
|---|---|
| Total Energy Consumed | 1,597 Million Btu / yr |
| Total Energy Index | 51.5 kBtu / sq ft / yr |
| Total Energy Cost: | $33,615 / yr |
| Total Energy Cost Index: | $1.08 / sq ft / yr |

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# Lighting Summary

For all lighting upgrades:

- Determine illumination level needed and required lumens per fixture
- Specify color temperature and minimum color rendering index

For replacing bulbs:

- Specify Energy Star and above average performance in terms of lumens per Watt
- Evaluate samples for acceptable spatial distribution and color
- Check compatibility of bulbs with dimmers, transformers, etc.

For recessed fixtures (downlights and troffers):

- Integrated lamps and fixtures are likely to provide greatest energy saving

For outside lighting:

- Use directionality of LEDs to provide more uniform illumination with less lumens

LED upgrades can be cost competitive now.
Incentives and rebates expand types of viable projects.
LED performance is improving annually and prices will continue to fall.

# Don’t Pay Sewer Charges on Water You Don’t Discharge

- Water/sewer bills typically based on “water use”
- Some water/sewer authorities will reimburse you for water, not discharge
- Ask your water authorities if you have:  Cooling towers, irrigation systems, use significant water in your products
- Typically requires a  sub-meter.

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# Kitchen Checklist

- Use low-flow pre-rinse sprayer
- Keep stoves and griddle, ranges pushed back (under ventilation)
- Avoid excessive pre-heating
- Turn off unneeded section – (i.e.; broilers, griddles, etc.)
- Scheduling and cleaning are important
- Resource: http://fishnick.com/

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# NC Rest Area Breakdown

| | T12 | Incan | Merc | HPS | Exit | Delamp | Motion | Tstat | HVAC | Vend | Water cool | Admin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brunswick | 601 | 94 | | | | | 63 | 116 | | 146 | | |
| Buncombe | 698 | | 378 | | | | 438 | 2066 | | 1135 | | |
| Camden | 146 | | | 829 | 225 | | 135 | 128 | | 635 | | |
| Cherokee | 322 | | | | 21 | | | 150 | 125 | | | |
| Cleveland | 489 | 292 | | 493 | | | 505 | | | 552 | | |
| Cumberland | | 496 | | | | | 890 | | | 968 | | |
| Duplin | | | | | | 165 | 50 | | | 800 | | |
| Granville | | 390 | 751 | | | 9 | 577 | | 2879 | 824 | 40 | |
| Johnson | | | | | | 466 | | | 566 | 972 | | |
| Polk | | 111 | | | | | 241 | | | 539 | | |
| Surry | | | 214 | | | 293 | 1527 | | 1321 | 286 | | 2765 |
| Percentage | 8% | 5% | 5% | 5% | 1% | 3% | 15% | 9% | 17% | 24% | 0% | 10% |

**Lighting 41%, HVAC 25%, Vending 24%, Misc 10%**
**Opportunities represent 19% of total energy cost**